

Single Top CSC Note status report

Simona Rolli

Several groups/people active

- Arnaud, Benoit, Florent
 - ♦ -ntupleMaker, common infrastructure
- Akira
 - ♦ -TopView common ntuples
- Simona
 - ♦ - btagging performance all channels
- Mohsen, Claudiu
 - ♦ -reco efficiency and purity of jets all channels
- Nathan -
 - ♦ NN t-channel analysis
- Reinhard, Bernard, Alessandro
 - ♦ - trigger studies

<https://twiki.cern.ch/twiki/bin/view/Atlas/T8SingleTop>

MC sample status

- Signal:
 - ♦ Wt sample 5500
 - ♦ s-channel sample 5501
 - ♦ t-channel sample 5502

} Advanced production
Just started!
- Backgrounds
 - ♦ Top sample 5200/5204/5205
 - ♦ W+jets - lots of discussions
- Most of the current work is related to getting familiar with the infrastructure (for those who are new to the analysis framework and comparing with Rome samples for those previously active)

Jet Studies: Definitions

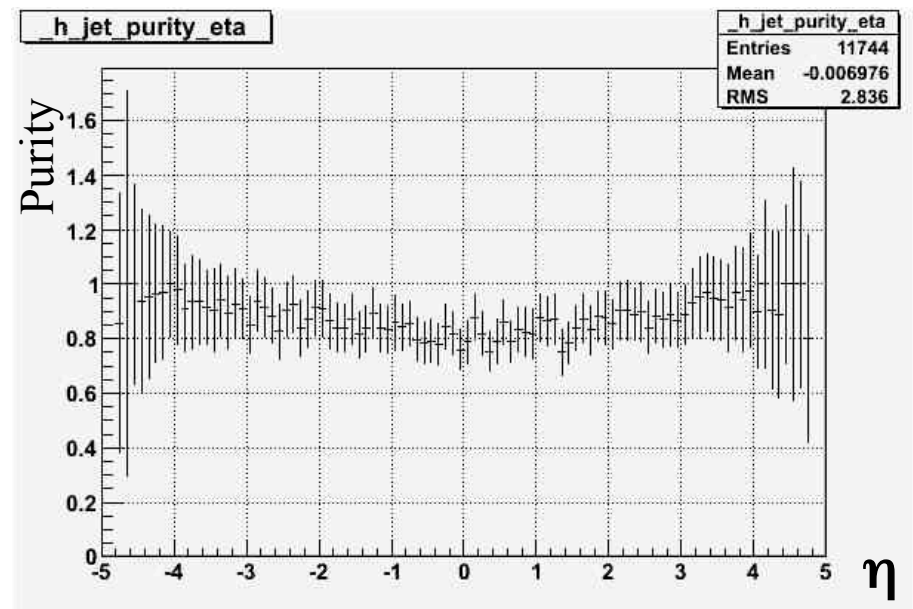
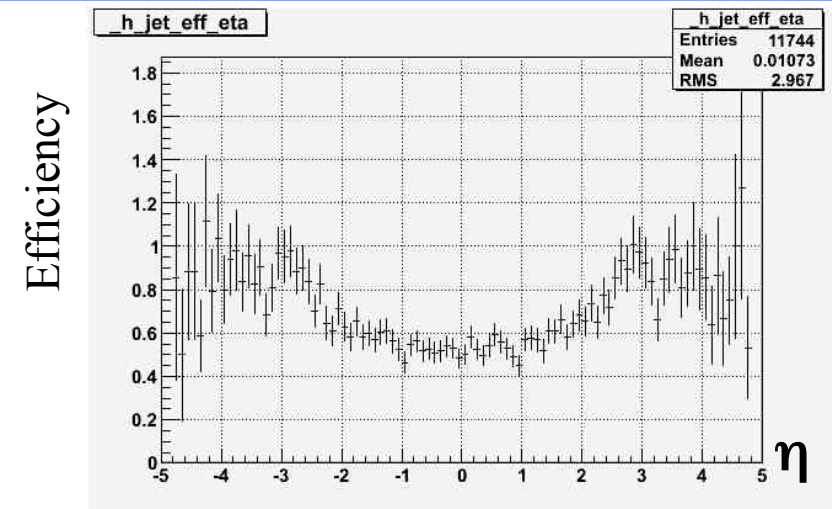
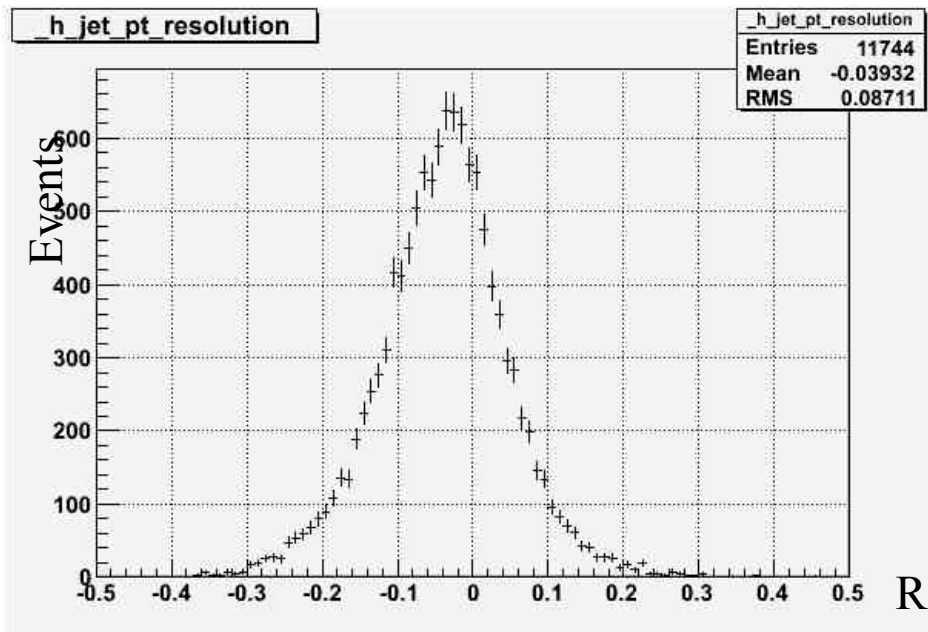
Claudiu Cojocaru_Mohsen Khakzad,
Gerald Oakham, Manuella Vinciter
Carleton University

- **Efficiency** = Number of Reconstructed Jets that match to a Truth Particle Jet / Number of Truth Particle Jets (bin by bin - Eta bins)
- **Purity** = Number of Reconstructed Jets that match to a Truth Particle Jet / Number of Reconstructed Jets (bin by bin - Eta bins)
- **Jet matching** = $\Delta R(\text{jet1}, \text{jet2}) < \Delta R_{\text{CutOff}} (0.2 \text{ or } 0.1)$

First look at CSC t-channel

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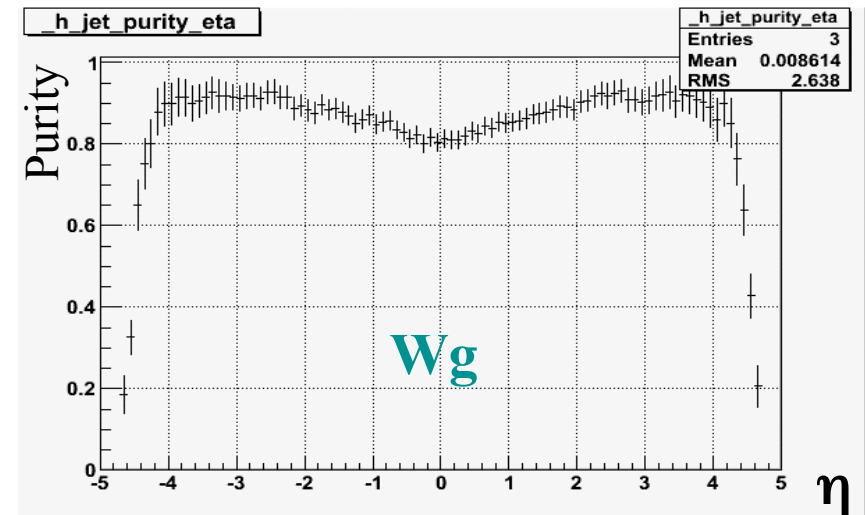
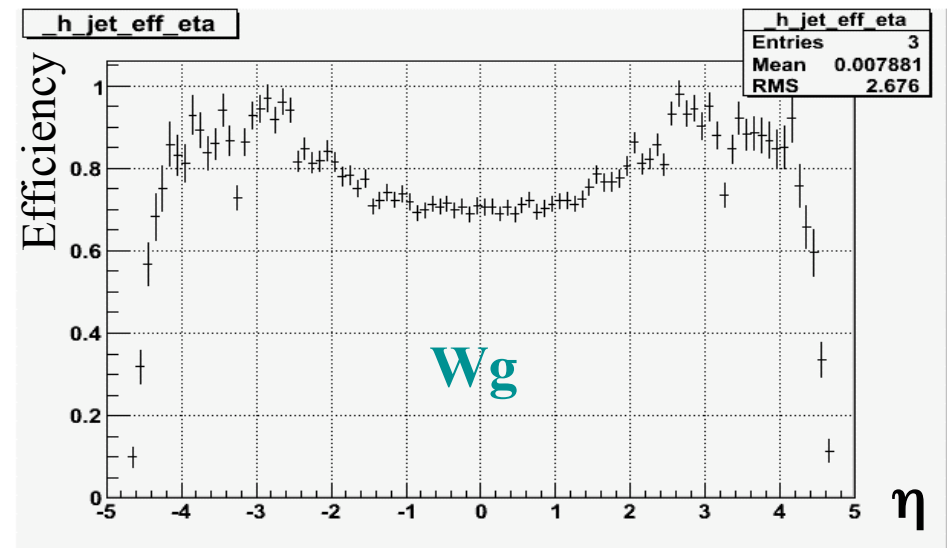
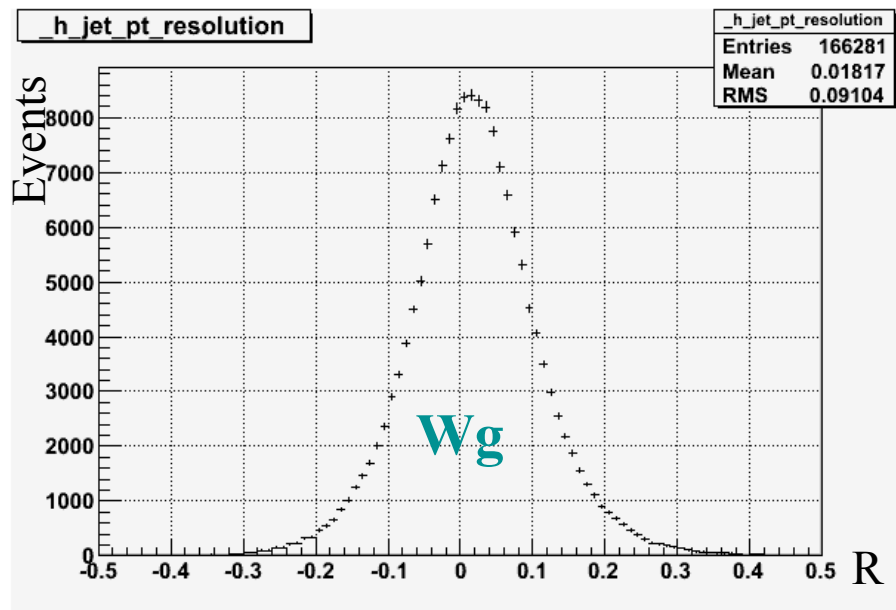
- **Cuts applied: $Pt > 30$ GeV, $|\eta| < 5.0$**
 - ♦ CSC samples (7 AOD files ~ 6400 events)!
 - ♦ TopView in Athena 11.0.5
 - ♦ No backgrounds
 - ♦ Jet algorithm: Cone04
 - ♦ DeltaRCutOff = 0.1
- **Resolution $R = \frac{Pt_{rec,matched} - Pt_{truth}}{Pt_{truth}}$**



Compared with Rome data

Carleton University

- Cuts applied: $P_t > 30 \text{ GeV}$, $|\eta| < 5.0$
 - Rome samples
 - No backgrounds
 - Jet algorithm used:
 - Cone04
 - Cone07
 - KT
 - DeltaRCutOff = 0.1
- $R = (P_t\text{reco_jet}/P_t\text{truth_jet})_{\text{matched}} - 1$



B-tagging performance estimators

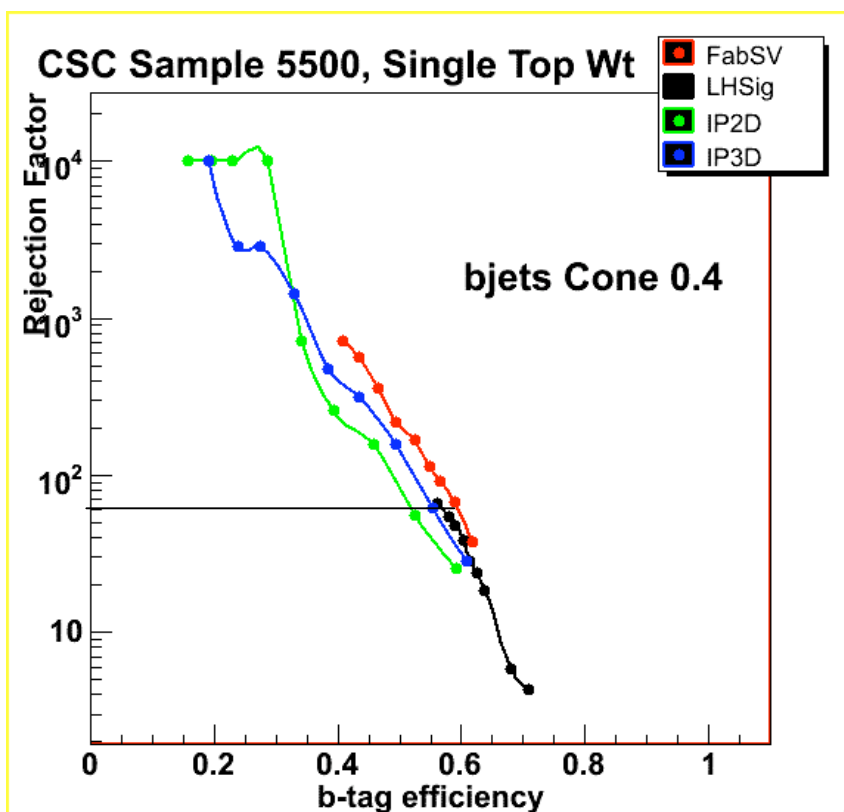
Simona Rolli
Tufts University

- B-jet efficiency ε_b as function of variable cut:
 - ♦ Denominator:
 - jets defined as b using MC truth
 - with fixed p_T and η cuts ($p_T > 50 \text{ GeV}/c$, $|\eta| < 2.5$)
 - ♦ Numerator:
 - ditto + cut on a tagging weight
- Light-jet rejection $R_u = 1 / \varepsilon_u$
 - ♦ $R=100$ means 1% mistag rate
 - ♦ light jets: u, d, s, g
- B-jet efficiency as a function of P_T and η
 - ♦ Denominator:
 - jets defined as b using MC truth
 - with fixed cut on weight ($SV1 > 3$, $LHSig > 0.9$)
 - ♦ Numerator:
 - ditto + cut on p_T and η

Btagging performance: Wt channel

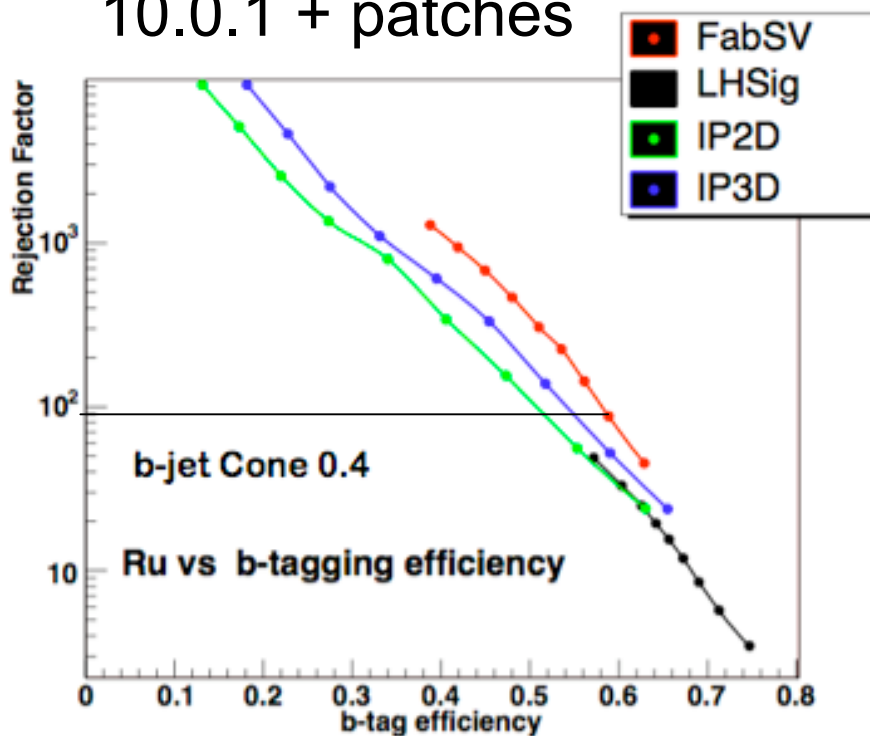
CSC sample 5500, 5000 events

11.0.5



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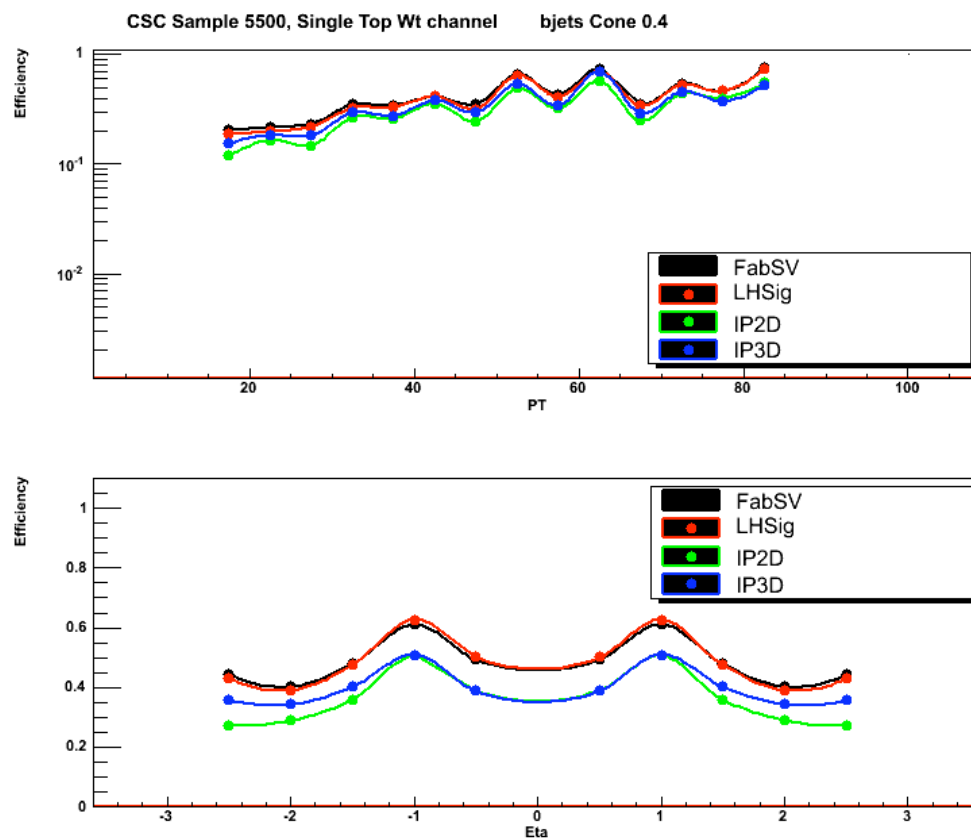
10.0.1 + patches



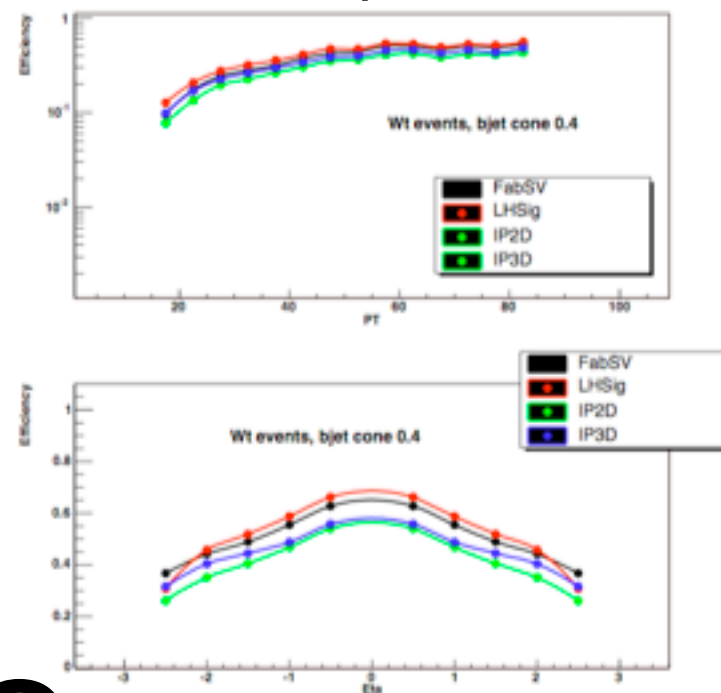
Btagging, Wt efficiencies

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11.0.5, 5k events



10.0.1 + patches

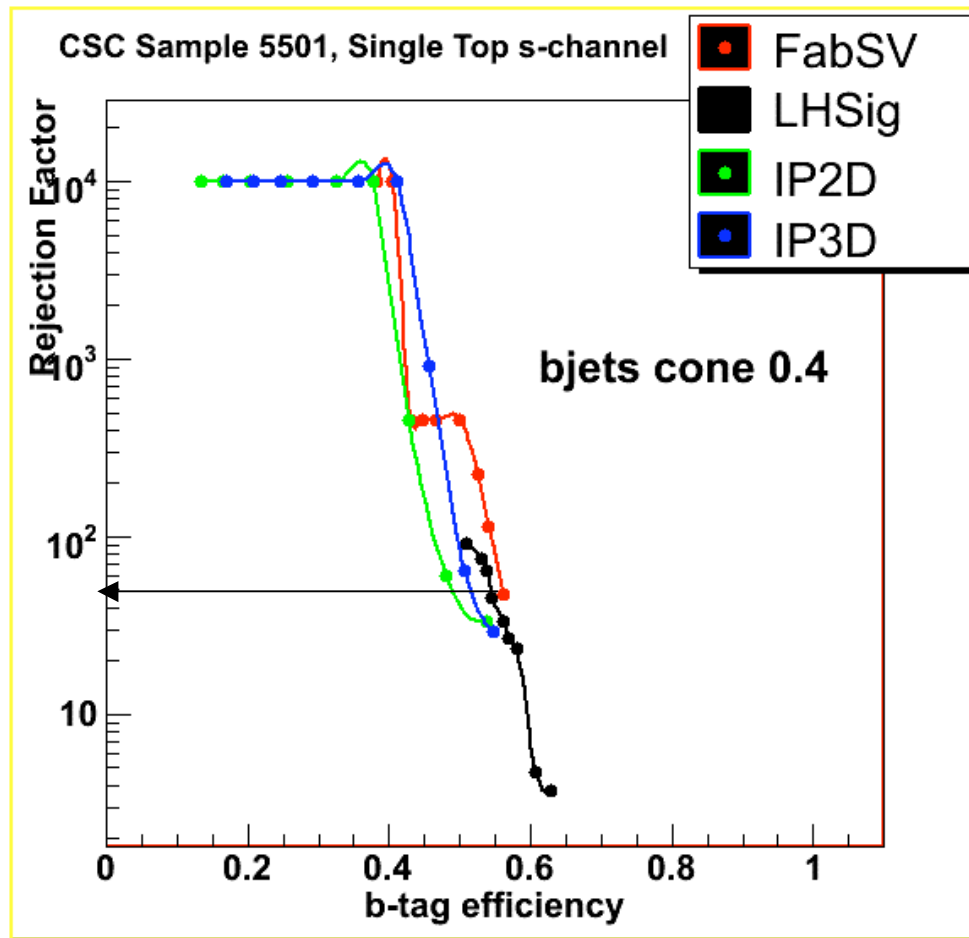


?

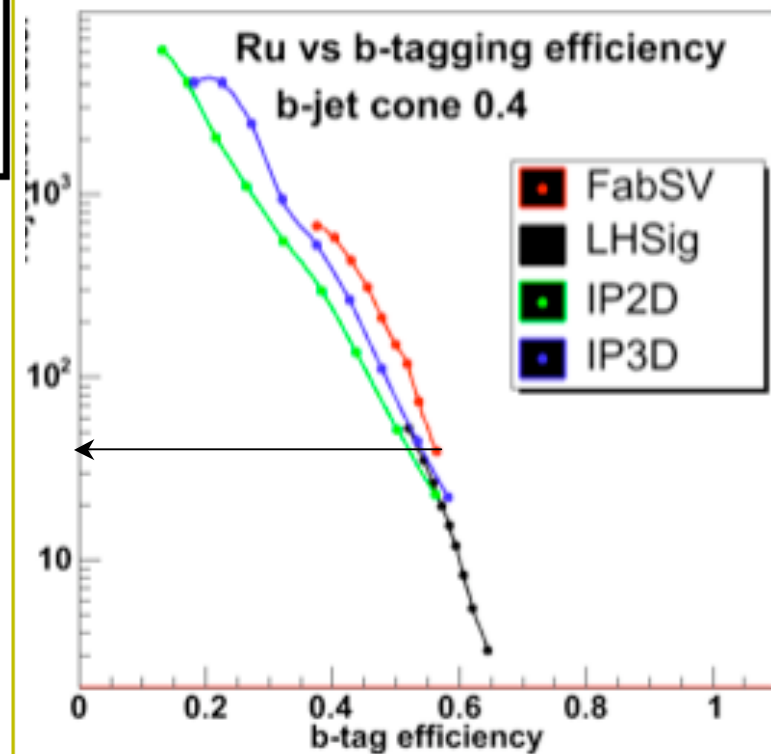
Btagging performance: s-channel

CSC Sample 5501, 50k events
11.0.5

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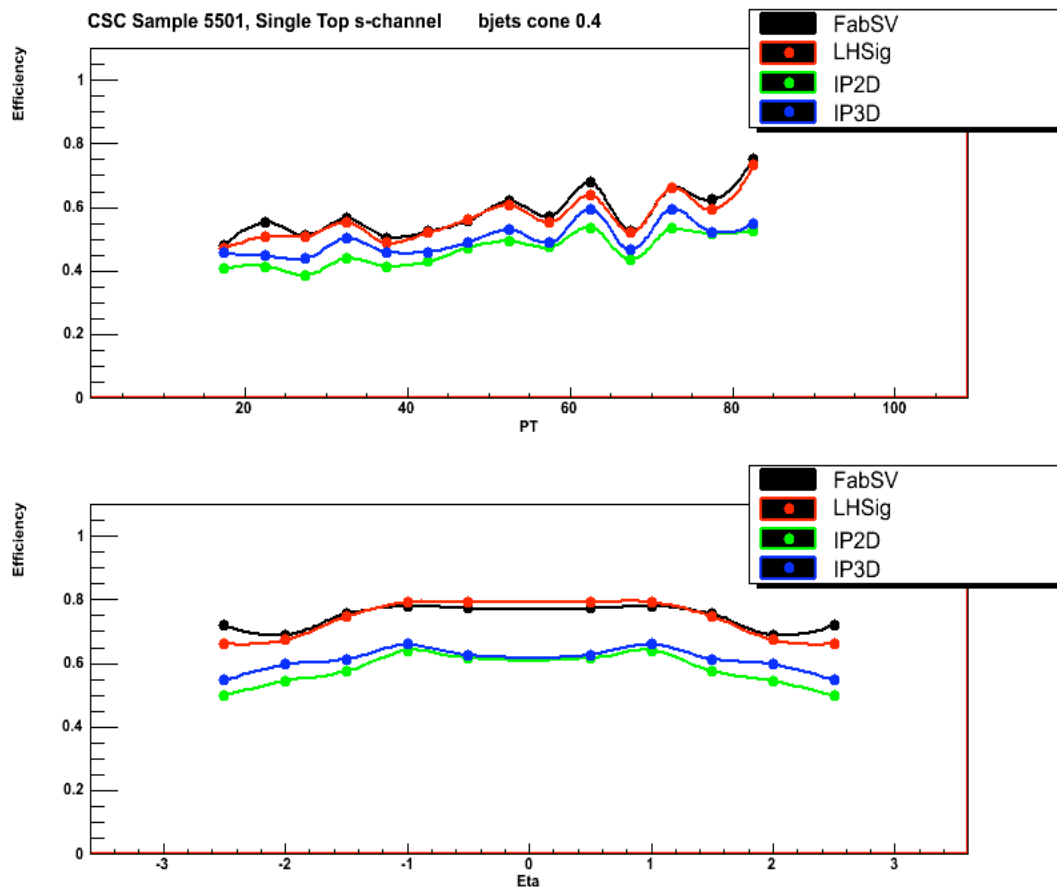
10.0.1 + patches



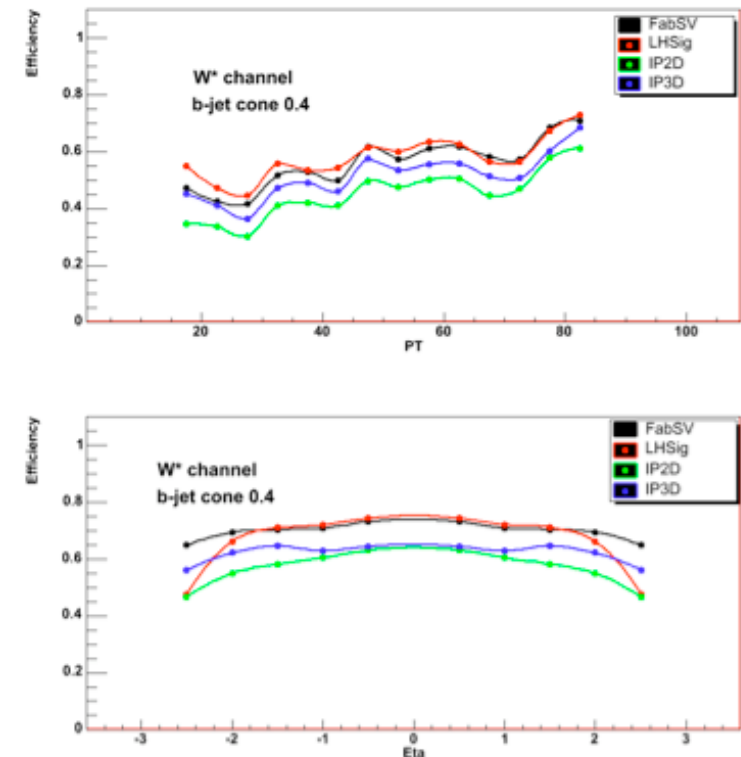
Btagging, s-channel efficiencies

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11.0.5



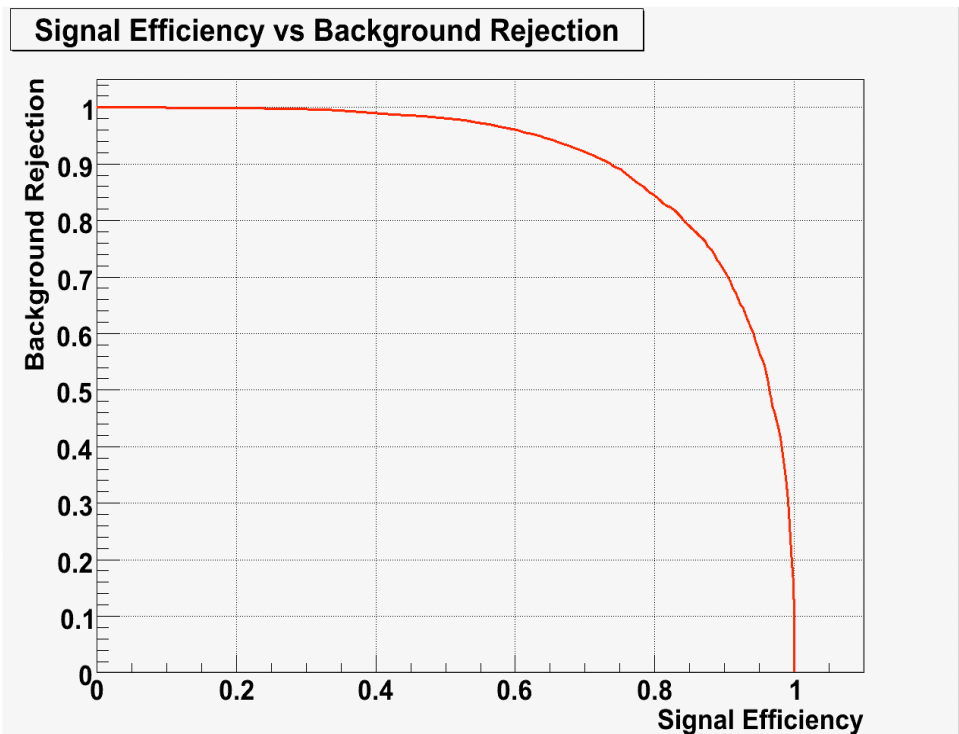
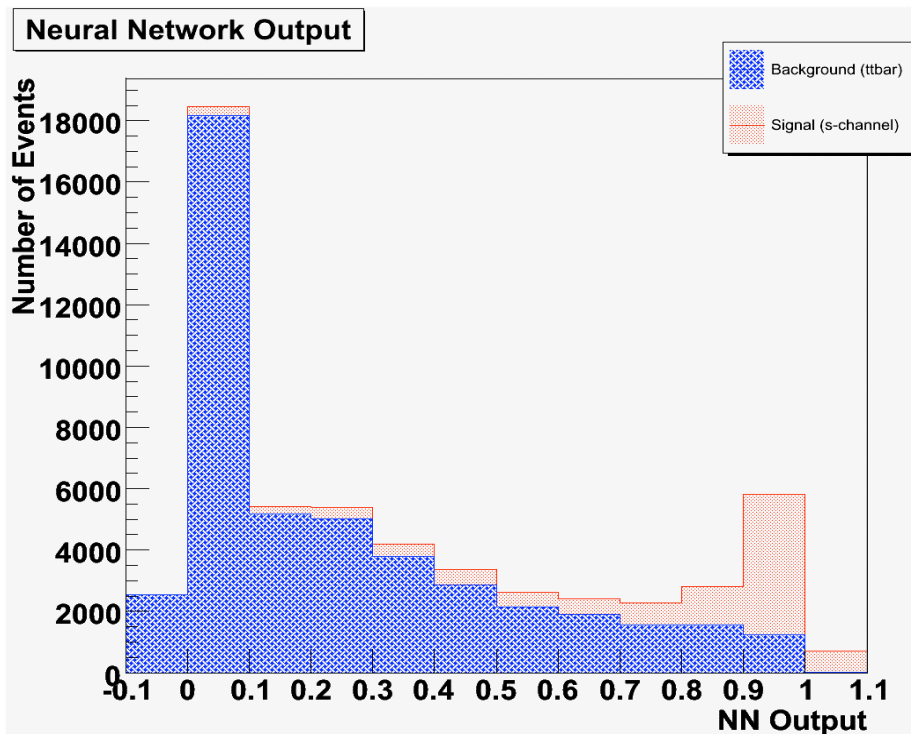
10.0.1 + patches



Neural Network t-channel analysis

Nathan Triplett
Iowa State University

- Still waiting on CSC t-channel data and background data.
 - Until then, Rome data is being used to test analysis code. This should allow for a faster turnaround time once the CSC data is available.
- Example NN output for t-channel vs ttbar background shown below
 - The same techniques will be used for the other backgrounds

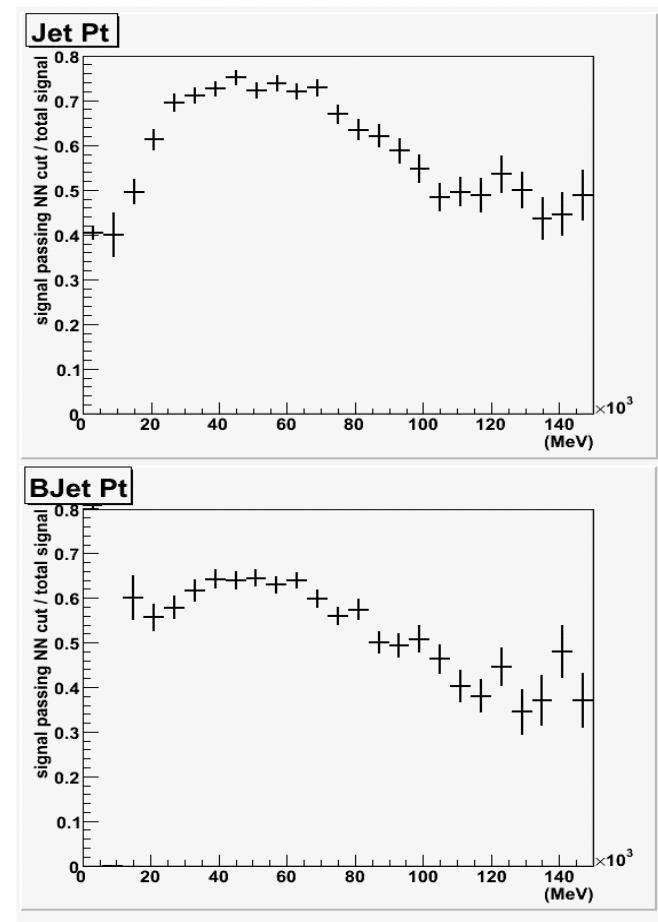


Neural Network t-channel analysis

Nathan Triplett
Iowa State University

- Looking at the correlations of input parameters to the NN can help to optimize the NN
 - Parameters highly correlated in BOTH the signal and background imply only one of those parameters may be needed.
 - A large difference between the correlation of signal and background parameters implies that they are important parameters for both a NN and perhaps for other methods.
- One note of caution relating to the NN!
 - The NN will select an odd subset of the signal, as shown in the figures.
 - This will likely introduce a bias into the sample.
 - Care should be taken if using the NN selected events for other analysis, for instance polarization studies.
 - This method, however, should be good for a fast discovery of single top.**

The NN selected sample of the t-channel pt spectrum, normalized by the total t-channel sample.



TopView common ntuple

Akira Shibata
Oxford University

- Common ntuples are provided for those who do not want to use their own ntuplizer code: TopView
- The objects definition suggested in the Twiki page is implemented and files are available through dq2 with the following dataset name
 - ♦ user.akirashibata.TopView1111_SingleTop.005001.pythia_minbias.001
 - ♦ user.akirashibata.TopView1111_SingleTop.005501.AcerMC_schan.001
 - ♦ user.akirashibata.TopView1111_SingleTop.005500.AcerMC_Wt.001
 - ♦ user.akirashibata.TopView1111_SingleTop.005205.AcerMCTtbar.001
- user.akirashibata.TopView1111_SingleTop.005204.TTbar_FullHad_McAtNlo_Jimmy.001
- user.akirashibata.TopView1111_SingleTop.005202.Mcatnlo_jim_top__leptpt120.001
- user.akirashibata.TopView1111_SingleTop. 005201.Mcatnlo_jim_top_pt200.001
- user.akirashibata.TopView1111_SingleTop.005200.T1_McAtNlo_Jimmy. 001

Validation plots at:

<https://twiki.cern.ch/twiki/bin/view/Atlas/ST5200Validation>

W+jets generation

Benoit Clement
Grenoble

- The samples generated for pair top analyses are inadequate for single top
 - ♦ 3 jets filtering with high P_T threshold
- Several filtering configurations ran
- It might be impossible to produce enough W+jets fullsim with low multiplicities.
- **Proposal:** as many of these events will be killed by tagging, one might choose not to tag the W+jets MC and weight the events by their tagging probability.
- The number of events needed would therefore be reduced by a factor equal to the mistag rate. Then 200k or 300k events could be enough. (note that, for other reasons, this weighting procedure has been extensively used at D0)

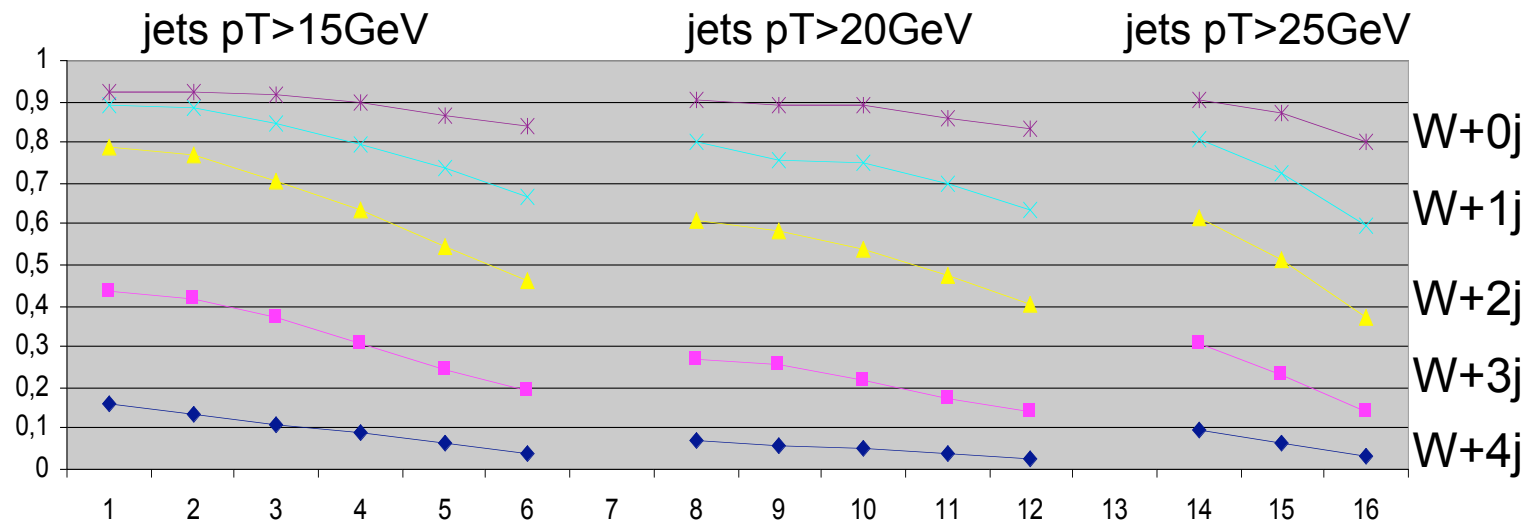
Filtering efficiency and Effective X-sections (LO)

Benoit Clement
Grenoble

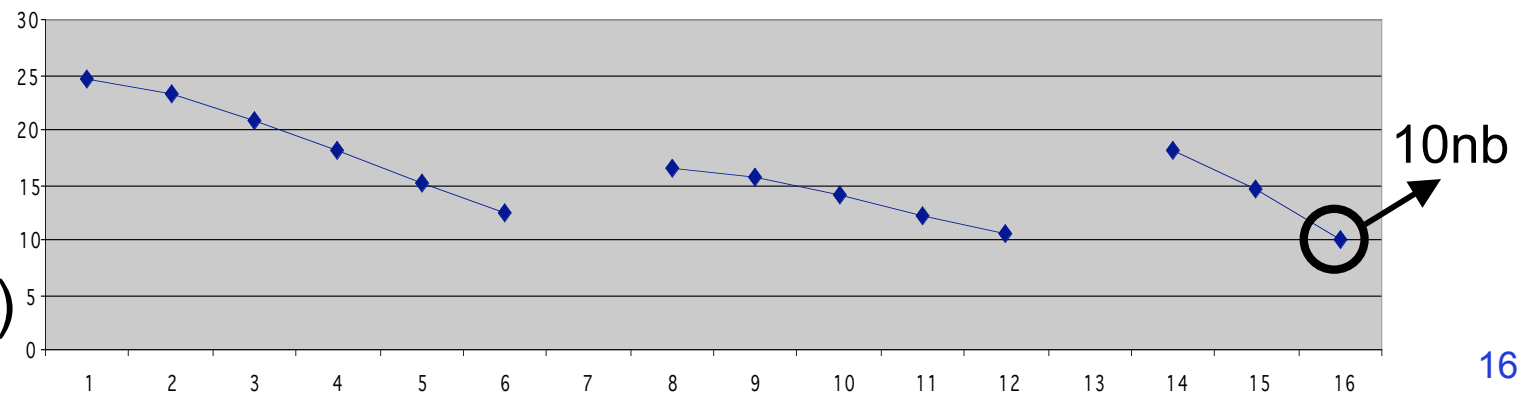
At least 2 jets, lepton $P_T > 20$ GeV, $MET > 15$ GeV

jets $P_T > 15 - 25$ GeV (Leading jet P_T (top) $> 15 - 40$ GeV)

Efficiency



Effective
Xsection (nb)



t-channel specific filter

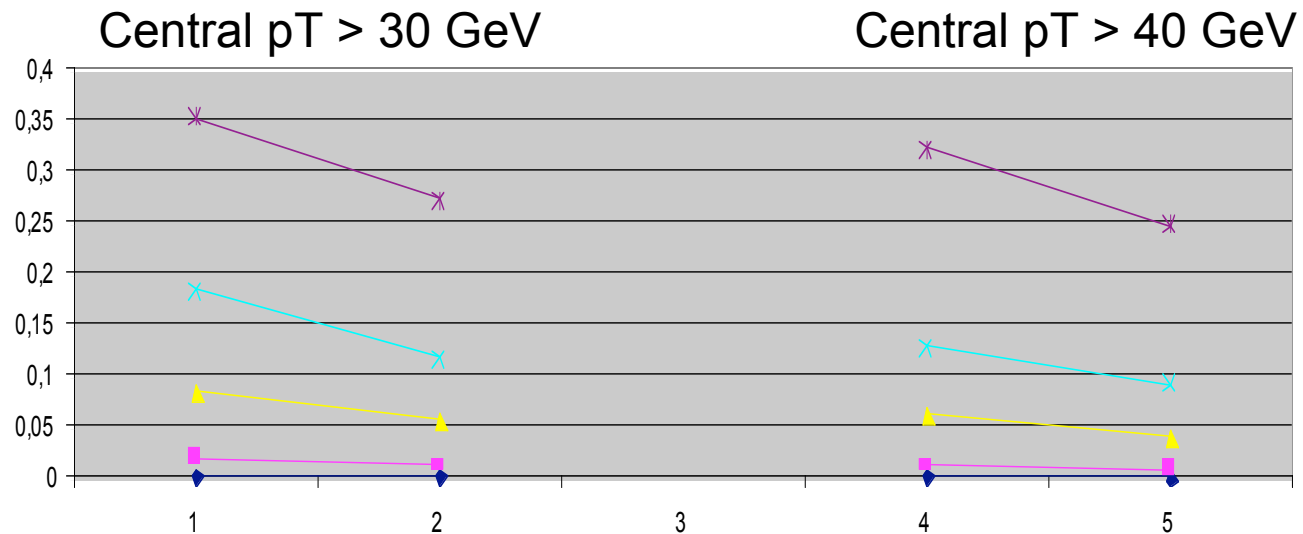
Benoit Clement
Grenoble

At least 2 jets, lepton $P_T > 20$ GeV, $MET > 15$ GeV

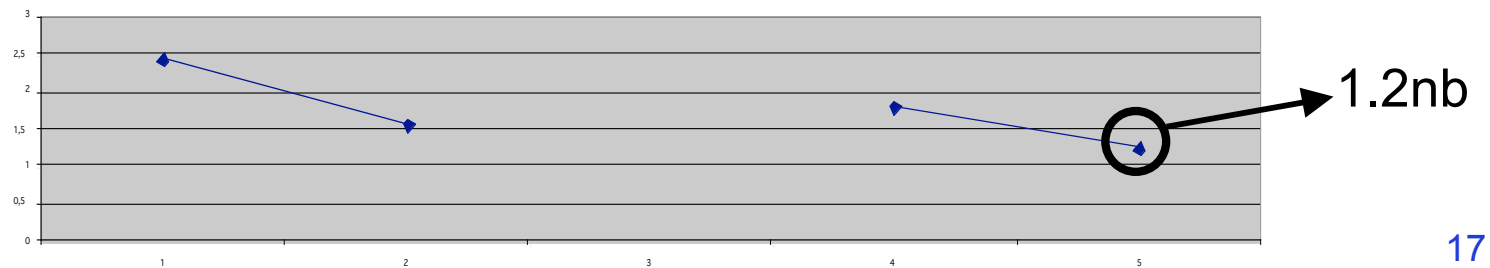
1 central jet (b from top) $P_T > 30 - 40$ GeV, $|\eta| < 2.5$

1 forward jet (light) $P_T > 30 - 40$ GeV, $|\eta| > 2.5$

Efficiency



Effective
Xsection (nb)



Final remarks

- MC samples still in production
 - ◆ Particularly true for W+jets background
 - Generation strategy being defined now!
 - Some fastsim AOD soon available
- Performance notes needed for physics object definition:
 - ◆ High P_T leptons
 - ◆ B-tagging